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THE TEMPERATURE OF THE THAMES.

FORTY years ago, at the suggestion of the medical officers in the department of the Registrar-General, arrangements were first made for obtaining a daily record of the temperature of the river Thames.

In those days (as pointed out by Luke Howard) the pattern of thermometer invented by Six had been so far departed from, with a view to cheapness and commercial objects, that it had passed into disrepute, and therefore the thermometers supplied were on Rutherford's pattern, which was perfect for recording the lowest temperatures, but extremely bad for registering the highest points reached. These thermometers were enclosed in an upright wooden trunk attached to the side of the Dreadnought Hospital ship, which was moored in the river a little above Greenwich. This wooden trunk was closed at the bottom, and extended from a foot or two above, to 3 ft. below, the ship's water line, and that portion of the trunk which was below the water line, and also the bottom board, was pierced to ensure circulation. The thermometers were suspended 2 ft. below the water line. These observations commenced in May, 1844; the only important change for the following 26 years was the substitution of a Negretti's patent maximum for the defective Rutherford thermometer.

In April, 1870, these Dreadnought observations ceased, and there was no record until 1871—in fact, the changes since then have been somewhat numerous, and must be dismissed briefly. The general system of mounting the instruments and of observing has been adopted throughout. From January, 1871, to May, 1874, the observations were made from the police ship "Scorpion," moored between Greenwich and Blackwall. In May, 1874, they were transferred to the "Royalist," moored in the same place; but in October, 1879, the "Royalist" was run into, and after repair she was placed on the river bank, where observations were impossible, and all records ceased.

The late Astronomer Royal, Sir G. B. Airy, K.C.B., F.R.S., has recently published in the *Proceedings of the Royal Society* an analysis of the whole of the observations. From it, and from the weekly

returns published by the Registrar-General, the broad features of Thames temperature seem to be as follows :—

On the average of 33 years the temperature of the river (51°·7) is higher than that of the air at the Royal Observatory (50°·2) by 1½°. During the seven months, May to November, this difference averages 2°·0 ; and during the winter, December to April, only 0°·7.

On the average of the 33 years, July gives the highest monthly mean river temperature, 65°·7, and January the lowest, 39°·4.

If, however, we look to individual months, we have some very much wider extremes : for instance, the average for June, 1846 (a very hot month), was 73°·1. In 1859 (when it will be remembered there were loud complaints of the state of the river) the temperatures were remarkably high ; in every month, except April, May, and December, they were above the average, and five of the months were hotter than any corresponding month during 33 years. The coldest month seems to have been January, 1850, of which the mean temperature of the river is said to have been only 33°·0.

The highest temperature recorded seems to be 77°·0 on June 21st, 1846, but that was in the days of Rutherford's maximum, and the heat was too much for it, as on the next day it had to be sent away for repair. The next highest reading, and probably a true one, was on July 20th, 1859, 75°·4.

As regards lowest temperatures, it seems difficult to be certain. Pure water freezes at a point very slightly below 32°. Sea water freezes at about 27°·7. It is, perhaps, an open question at what temperature ordinary Thames water freezes, but in 1850 temperatures below 32° are reported daily from January 1st to 24th, and there is an entry of 29°·4 on January 15th.

The fact that no observations had been made for upwards of three years having come to the knowledge of the Committee of the Corporation, which acts as Port Sanitary authority for London, instructions were given to Mr G. J. Symons, F.R.S., to sketch a scheme of observations to be organized and continued at their expense.

Some years back the Corporation purchased the Dockyard at Deptford, and converted parts of it into a Foreign Cattle Market ; for the convenient unloading of vessels three jetties are run out (each about 200 feet) into the river. The extremities of these jetties have a depth of eleven feet of water even at dead low water ; there is, therefore, at all times, more than sufficient volume of water entirely to annul any warming or cooling effect due to shallow shore water. The position is very near to (in sight of) that occupied for more than a quarter of a century by the Dreadnought. Lastly, there is resident on the spot Mr. Philcox, the Clerk of the Market, and several officers have been trained as observers, so that continuity and regularity is assured, and for these reasons this locality has been selected.

For observations of river or sea temperature it is imperative that the thermometers be so constructed as not to be liable to derangement in pulling up or letting down. For this reason a very carefully

made form of Six's thermometer has been adopted, something like those used at sea, but specially adapted to the circumstances. Two have been provided—one to show the highest and lowest temperature within a foot of the bed of the river, the other floating with the tide but always two feet below the surface of the water. Both thermometers hang in a perforated shaft, which reaches from nearly the bed of the river to far above high-water mark, in fact to a small chamber into which the thermometers will be wound for the purpose of reading them and setting the indices.

Besides these river temperatures, a set of air thermometers, &c., has been erected on a grass plot opposite to the offices, and these will supply all the data required from a climatological station, and a copy of the results will be forwarded to the Meteorological Society for publication, with other Metropolitan returns, in the *Quarterly Record*. These observations will be of considerable interest when compared with those on the Observatory Hill at Greenwich, which have so long been taken as representative of the climate of London.

In the organization of the river observations Mr. Symons has had the advantage of consulting Mr. W. H. M. Christie, F.R.S. (Astronomer Royal), and Mr. Ellis, under whose supervision the later river observations were made; and copies of the new river temperatures will be sent regularly to the Royal Observatory for examination and for publication in the *Weekly Returns of the Registrar-General*.

As regards the accuracy and efficiency of the instruments, it is probably unnecessary to say more than that they have all been made by Messrs. Negretti & Zambra, and all verified at Kew, and as regards accuracy in the observations, extreme simplicity has been aimed at, but at the same time several of the observations are made self-checking, while, as above stated, the river observations will be regularly checked at the Royal Observatory, and the climatological ones at the office of the Meteorological Society.

If any of our readers wish to see the instruments they can do so by presenting their cards at the principal entrance to the Foreign Cattle Market, Deptford, on Saturday, May 19th, between 3 and 5 p.m.

AN ARTIFICIAL AURORA.

WE are very glad to find in the last number of the *Mittheilungen der internationalen Polar-Commission* a full description of the experiments made by Prof. Lemström, of which we gave some newspaper reports in our last number.

Prof. Lemstrom's communication is too long for transfer to these pages, and, as we have just mentioned, has been anticipated by telegraphic reports. The opening chapter giving an epitome of the origin of the experiments is, however, so interesting that we give a translation of it, almost without abridgment :—

HISTORICAL INTRODUCTION.

"Amid the almost countless forms presented by auroræ, there is one of special interest as indicative of its origin. This form, which was observed during the Swedish Polar expedition of 1868, consists in thin flames or a phosphorescent glow surrounding elevated objects, and especially mountain tops. This characteristic is so marked that it needs no training to observe it, for it was observed by our celebrated philologist, M. A. Castrén, during his voyages in Siberia, and by him very tersely and accurately described.

"My first experiments in 1871 were suggested by what I had myself observed in Spitzbergen, and were directed towards ascertaining whether a similar appearance could not be produced, or at least, developed by suitable methods.

"Starting with the hypothesis that auroræ in general, and especially the above-named variety thereof, are due to electrical currents in the atmosphere, I erected on the summit of Luosmavaara, about 560 feet above Lake Enare* an apparatus composed of a corona of numerous fine points of copper wire united to a single copper wire, this coronet, about 8 in. square, was placed on the top of a tall pole. From it an insulated copper wire (0·015 inch in diameter) led to a galvanometer, which was placed in a room at the rectory of Enare, about 2½ miles distant; another copper wire was led from the galvanometer to a plate of platinum buried in the earth. When the connection between the coronet and the earth was broken, the needle of the galvanometer was appreciably, though but slightly, deflected. The very night (November 27th, 1881) after the apparatus had been erected an aurora began, the first manifestation being a single ray perpendicularly over Luosmavaara. This ray gave in the spectroscope the true greenish yellow auroral line, but it was not certain whether the ray was truly vertical over the mountain or behind it. Subsequent observations, which I will presently mention, render it nearly certain that the ray was produced by the apparatus.

"During the same expedition, but a few days earlier (November 21st, 1871) while studying the spectra of the flames on surrounding summits which, on that day, were somewhat brighter than usual, we found that the spectroscope gave the greenish yellow line from nearly all the surrounding objects, the ice of a pond, the roof of a house, and even (but very feebly) from the immediate vicinity of the observer. These observations led me to believe that I was then in the midst of a feeble aurora, and from that time onwards it has always been my wish to subject auroræ to further practical tests. This desire was also strengthened by an accident, viz., the appearance of light in a Geissler tube, which was not in direct connection with any electrical machine. For this accident led to researches which proved that the current which leaves one pole of an electrical machine, while the other pole is connected to earth, may pass obscurely through a stratum

* In Lapland, about 140 miles south-east of North Cape.

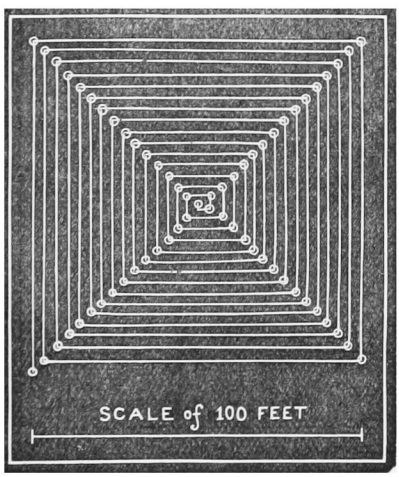
of air of ordinary density, but produce light in a stratum of diminished density.

"I must, however, reserve for another occasion many details, and pass at once to the origin of the present experiments.

"The information respecting auroræ which I gained by long experience, but especially the facts already mentioned, led me to believe that an experiment on a large scale, in which the principal part should be left to Nature, and her efforts should merely be assisted, would probably lead to positive results, and also furnish facilities for the study of the phenomenon.

"Although not certain of success, I felt it to be my duty to submit a proposal of this nature to the International Polar Commission at St. Petersburgh, in August, 1881."

Prof. Lemström then explains that various causes conspired to delay his operations, and that, finally, he had to start with somewhat makeshift apparatus. His first experiments made upon a clock-tower at Sodankylä were unsuccessful. He therefore removed his apparatus to the top of Oratunturi, a mountain 12½ miles from Sodankylä and in lat. 67° 21′ N, and lon. 27° 17′ E. The summit is about 1,798 feet above the sea, and 971 feet above the village of Sodankylä. His so-called discharging apparatus, placed on this summit, consisted of a stout copper wire, 0·08 inch in diameter, supported on insulators fixed to posts 8 feet high. The wire was arranged in a rectangular spiral, somewhat as shown in the annexed diagram, the posts being at the angles, and no two lines of the wire



at a less distance than 3 feet; the wire was studded with brass needle-points at each 20 inches. Judging from the description, the coronet must have contained about half-a-mile of wire, and been studded with more than 2,000 points. An insulated wire was led from the interior extremity of the spiral to a rough shed about 600 feet lower down the mountain, in which it was connected to a galvanometer, whence another wire was carried to "earth" in a small stream.

This apparatus was completed on December 5th, 1882, and thereafter there was nearly every night a yellowish-white light over the summit, though none was visible on any adjacent mountain. The light was a flashing one, that is to say, very variable in intensity, and always in motion. Examined on three occasions by the spectroscope at a distance of 2½ miles, it gave a feeble continuous spectrum from D to F, upon which could be observed the auroral line $\lambda = 5{,}569$ faint, and varying in intensity. The galvanometer always showed a positive current from the coronet to the earth. The temperature was, however, very severe, generally about – 20° F (52° below freezing), and the apparatus was constantly being deranged and damaged by the masses of hoar frost which formed upon it, destroying the insulation, and frequently breaking the insulated wire between the coronet and the cabin.

Subsequently Prof. Lemström erected a somewhat similar apparatus on Pietarintunturi, a mountain near "Kultala (lat. 78°32′ N. lon. 27° 17′ E.)" [There is some mistake here, probably this a place shown on the U. K. map as Kustala in lat. 67°50′ N. and lon. 25°35′ E. and about 40 miles N.W. of Sodankylä]. Here experiments were possible on only two days, but on the first of them, December 29th, 1882, an auroral streamer about 400 feet long was formed, which observations from several azimuths proved to be exactly over the apparatus.

What with anxiety to be certain of this, what with the difficulty of manipulating the apparatus in the temperature of about 20° below zero Fahrenheit, and what with the difficulty of separating the light of this streamer from that of a faint general aurora, no spectroscopic observation was made, but Prof. Lemström feels sure both from his experiments in 1871, from those at Oratunturi in the early part of December, 1882, and from the galvanometer readings on this occasion, that it would have given the true auroral line.

Prof. Lemström concludes with high praise to his assistants for their zealous aid in trying atmospheric conditions, and he certainly deserves the same himself, for he shared it all, and that the experiments were difficult, the following paragraph sufficiently shows :—

"Both sets of experiments were but of a temporary character caused by the difficulties which had to be overcome. In those at Oratunturi, the observer had first to travel 12½ miles, which took at least four hours, then to examine the whole of the apparatus, repair it where necessary, and clear it from hoar frost, and all this in a temperature far below zero. When all was ready, the extreme cold rendered the fingers so numb, that it was rarely possible to observe the galvanometer for more than 5 or 10 minutes without going to a fire to warm them. At Pietarintunturi, the distance to be travelled was much less, but it also was trying, as the observer had first to climb about 1,000 feet, and then to walk about two miles."

We congratulate Prof. Lemström on his success, and we rejoice in the fact that, as he lives under an Empire, the chiefs of which have

long been distinguished for their fostering care for scientific research, it may be taken for granted, that next winter will find him again in the Arctic circle, with apparatus thoroughly suited for the work. If that occurs, the days of the aurora remaining unexplained will probably soon come to an end, although, thus far, it seems as if the appearances produced were somewhat like those of a very diffuse St. Elmo's fire, or of a so called "brush discharge." But even if so, Prof. Lemström is the first to make or to see a St. Elmo's fire 400 feet long.

To the Editor of the Meteorological Magazine.

SIR,—The paragraphs produced under this head in the last number (April) of your Magazine claim considerable attention, but doubtless we still require more precise details before being able to pass a judgment upon them.

One point I feel I must touch upon. The vacuum experiments at the Polytechnic (dear to my boyhood) were then accepted in all faith, as illustrating the features and character of the auroral discharge. There was, however, no spectroscope in those days, and that strict analyser has now pronounced that all laboratory artificial auroræ, however much they may look like the northern lights, cannot by any persuasion or treatment be induced to yield the prominent and principal lines of the auroral spectrum, and, we may therefore conclude, are *not* of the same physical character. If Professor Lemström's experiments establish a permanent aurora, our chances of discovering its true nature will increase with its duration. Hitherto we have failed to discover any spectrum which, as compared with those of the aurora, will enable a lecturer to say, "Here, gentlemen, upon the table before you, you have in all respects a veritable auroral discharge." The spectra of stars, nebulæ, comets, &c., have been so seen in tiny glass tubes, but the aurora has baffled us hitherto.

Yours truly, J. RAND CAPRON.

Guildown, Guildford, April 18th.

THE METEOROLOGICAL SOCIETY.

THE usual monthy meeting of the Society was held on Wednesday evening, April 18th, at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair. T. G. Bowick, E. C. Clifton, H. Culley, Dr. W. Doberck, A. N. Pearson, Professor H. Robinson, C.E., and J. E. Worth were balloted for, and elected Fellows of the Society.

The following Papers were read:—

I. "On Cirrus and Cirro-Cumulus," by the Hon. F. A. Rollo Russell, M.A., F.M.S. The author points out that next to frequent readings of the barometer, and a knowledge of the distribution of atmospheric pressure, observation of the character of clouds, especially of cirrus, is of the greatest use in attempting to forecast coming weather. Observation of Cirrus can evidently be made use of in a

telegraphic system of weather forecasts, as easily as observation of the barometer, and the employment of a number of scattered cirrus observers largely increases the probability of the motions of this form of cloud being noted. The paper contains a description of twelve different varieties of cirrus with the weather they indicate, or at least precede, as observed by the author during the last eighteen years.

II. "Some Notes on Waterspouts; their Occurrence and Formation," by George Attwood, F.G.S. This contains an account of several waterspouts observed in the Pacific Ocean, and also one seen in the Atlantic Ocean. The author believes that the waterspouts in the Pacific Ocean, were caused by a cloud heavily charged with cooled moisture drifting from the high mountains of Costa Rica and coming into contact with air currents and clouds travelling in a different direction, and of a warmer temperature; by which contact the cloud heavily charged with moisture received a rotatory motion, causing it to discharge part of its moisture, and make it assume a cylindrical figure, and fall down by its own gravity.

III. "Records of Bright Sunshine," by W. W. Rundell, F.M.S. This is a discussion of some of the Sunshine Records made in the United Kingdom during the year 1881 and 1882, from which it appears that there is more bright sunshine upon the coast than there is inland.

IV. "Note on Wind, Cloudiness and Halos; also on results from a Redier's Barograph," by E. T. Dowson, F.M.S.

V. "On the Cold Weather of March, 1883," by W. Marriott, F.M.S. The weather of this month will long be remembered for its very cold, dry, and windy character. The winter had been very mild, dull, and wet, and continued so to the beginning of March. A sudden change, however, took place on the 6th; a severe northerly gale set in, accompanied by snow showers, This gale caused sad havoc among the fishing fleet on the east coast, no fewer than 382 men and boys being drowned. The temperature fell considerably, the maximum being below 40° in almost all parts of the country, and in the north of England only a trifle above the freezing point. The same conditions prevailed for the next two or three days, the temperature, however, falling still lower, and on the 10th the minimum occurred in the central and northern districts. The most remarkable weather of the month took place from the 21st to the 24th. Owing to a brisk fall of the barometer over France, an easterly gale was experienced over this country; and as the temperature was low and the air very dry, the wind was exceedingly bitter and keen, and its effect upon animal and vegetable life very serious.

GLOBE LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—I am much obliged by your remarks appended to my recent letter on this subject. Doubtless, so far as we know, the "slowness of motion," characteristic of this form of lightning, was missing in the Compton case; nor was any "explosion" mentioned as heard, unless the "crash of thunder" succeeding it was really such.

It is strange what vagaries lightning will sometimes play. I had recently brought to me a ball evidently largely composed of iron, spherical in shape, 14·38 oz. in weight, specific gravity 6·81. This had been found after a storm near the apparent place of fall of lightning, in a heap of refuse bark, thrown out from a barn door. In this heap was a round hole with charred sides, and at the bottom of this hole, 10 inches deep, was found the ball in question. As the finder was certain he had found a "meteorite," every means were taken by analysis, comparison, section, magnetic examination, &c., to ascertain its true character, and these proved it incontestably to be a charcoal smelted cast iron ball, probably of considerable antiquity, as charcoal furnaces have long ceased. There yet remained the charred hole to be explained, and upon seeking advice from Mr. Preece, he came to the conclusion that an offshoot from a flash of lightning, falling near even so small a mass, may have penetrated to it, and thus led to its discovery, and to the mistake about it.—Yours truly,

J. RAND CAPRON.

Guildown, Guildford, April 18th.

To the Editor of the Meteorological Magazine.

SIR,—Please afford a small space for the following brief note concerning a fire-ball, seen by my sister many years ago at the farm of Haggs, Glasford parish, Lanarkshire. She narrated the circumstances to me at the time, and last year I again questioned her on the subject. During a fearful thunderstorm the farm-hands were eagerly striving to cut and bring in a load of grass, but were obliged to give over in consequence of the lightning playing vividly on the scythes and forks. In the thick of the storm my sister saw a ball of fire, about the size of a boy's head, settle down on the ridge of a thatched outhouse. After remaining a few seconds, it fell gradually to pieces or powder, in a manner like to a shell of quicklime when slaked; the gleaming powder streaming down the thatch amid the pouring rain, but doing the roof no injury. If there was any noise from it, it was unheard.

I may add, that while my sister was resident there several years she frequently saw bog-fire wavering, flichteringly over the moss-haggs from which the farm took its name. But, as perhaps some New Forest naturalist may sigh,

Ah! Higher Culture's superseding
Poor old Spunkie's "Light and Leading."

HENRY MUIRHEAD, M.D.

Cambuslang, 30th April, 1883.

COMPLEX SYSTEM OF HALOS.

Sergeant Cardwell has sent us a drawing of a complex system of halos, observed by him from the Verne Citadel at Portland, on April 28th, 1883. As we find that he sent a similar drawing to the Editors of *Nature* and of the *English Mechanic*, in both of which journals it has been engraved, we do not reproduce it, especially as the engraving does not quite agree with the verbal description, owing probably to the absence of any angular measurements.

Unfortunately, there is no English work which treats the subject of halos in any detail, and up to the present time we are not aware that any complete nomenclature of halos has been proposed. It is nearly half a century since Prof. Bravais published his excellent *Mémoire sur les halos et les phénomènes optiques qui les accompagnent*, but no Englishman has had the courage to run the almost certain risk of pecuniary loss which the publication of such a work in this country would involve—unless, indeed, an author could be found well read in optics and a good colour draughtsman, for many of the phenomena are very beautiful, and the book might then possess a double claim, on art as well as on science. We have never seen the form sketched by Sergeant Cardwell, nor has it been sent to us before during the 17 years that the *Meteorological Magazine* has been in existence. Nor is there anything identical with it among the hundred or more varieties engraved in Bravais' *Mémoire*, but it has points in common with fig. 77 and with fig. 106, which represents a halo seen in 1684.

FOG GAUGES.

To the Editor of the Meteorological Magazine.

SIR,—Since 1865 I have kept an account of the average amount of fog, but on quite a different plan from those suggested in your Magazine. My plan applies equally to clear as to foggy weather. I observe the distance to which objects can be seen, and record the amount of fog on the following scale :—

Distance visible,	32 miles	Fog	4
,,	8 ,, ...	,,	8
,,	2 ,, ...	,,	16
,,	880 yards...	,,	32
,,	220 ,, —	,,	64

and so on, in inverse ratio to the square root of the distance visible.

The objects observed are any solid bodies, such as buildings, leafy trees, and hills in the daytime, and at night ordinary gaslights. I disagree with the opinion expressed on your page 21, that "the measure of obscuration depends on the angle subtended by the object," believing that the size and colour of the object make very little difference as to its visibility, which depends almost entirely on the amount of fog between it and the eye, and therefore on its distance. For a similar reason I often use an opera-glass, though at

other times the naked eye. As regards the lamps, no doubt a bright light is visible further than a small one, yet I do not think there is so much difference in this respect as you seem to suppose. I have an impression that a common gaslight is visible rather further at night than a dark object is in the daytime, but, as it is impossible to compare the two simultaneously, I cannot say whether this is so, and I do not think that the difference can be great.

The visibility of distant objects depends a good deal on their height, as the atmosphere is usually clearer high up than low down; at other times, however, the reverse is the case, so that the amount of fog recorded partly depends on the altitudes of the objects observed. My plan, therefore, is not an exact means of comparison between observations at different places, because the hills in view may differ in height; but where they are approximately of the same height, I think this plan would form a fair means of comparison. Also this difficulty does not usually affect actual fog, but only haze.

It was a difficult matter to decide on the scale to be adopted, in order to give satisfactory results in taking the averages. The simplest plan would be to let the distance visible represent the fog (or rather clearness, as in that case it would be), but this obviously would not do, for in taking the average, the densest fogs would affect the average only about as much as slight ones. Nor would a scale on the *simple* inverse ratio do, for in that case a very clear day would have no more perceptible effect than a moderately clear one. The scale I have adopted gives satisfactory results, though I am not sure whether a logarithmic scale would not be fairer still, as, for instance:—

Distance visible,	**32**	**miles**	...	...	...	...	**Fog**	**6**
,,	16	,,	...	...	...	...	,,	7
,,	8	,,	...	...	...	...	,,	8
,,	4	,,	...	...	...	...	,,	9

and so on.

THOS. WM. BACKHOUSE.

Sunderland, 24th April, 1883.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DEC., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	57·2	27	24·5	12	44·3	35·5	38·5	93	73·6	21·4	2·51	16	8·1
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·6	30	71·0	18	81·9	74·2	68·4	74	...	...	4·83	24	6·3
Calcutta	79·6	16	51·9	23	77·4	57·5	57·0	73	136·7	38·5	·00	0	1·8
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	89·5	8	66·2	16	84·6	69·4	66·1	69	144·2	54·3	·00	0	0·7
Ceylon	88·9	18	67·6	13	84·8	72·8	67·0	68	151·0	58·0	8·26	9	5·8
Melbourne	96·2	28	47·1	1	75·3	53·7	50·2	64	152·5	39·2	3·13	10	5·4
Adelaide	101·7	27	51·4	24	82·8	59·1	49·5	46	170·6	42·7	·37	6	4·6
Wellington	79·0	24	48·0	28	68·3	56·2	...	...	137·0	45·0	1·79	10	...
Auckland	79·2	9	52·2	28	72·9	58·1	55·1	70	135·5	41·8	1·37	8	5·9
Falkland Isles	69·1	16	36·5	20	55·6	41·8	43·1	76	134·2	27·9	2·58	15	6·9
Jamaica	89·6	10	67·8	31	86·1	70 9	69·1	78	...	58·0	·35	4	4·9
Barbados	81·0	var.	69·0	19	80·0	72·0	71·3	80	146·0	67·0	3·45	15	6·0
Toronto	40·1	4	4·1	9	30·9	20·0	23·8	83	101·0	—0·4	2·79	23	8·7
New Brunswick, S. John	48·0	6	5·0	29	28·8	15·5	20·4	89	...	...	2·82	14	5·2
Cape Breton, Sydney	49·9	6	13·2	29	35·2	23·8	26·3	84	...	...	2·42	16	7·1
Manitoba, Winnipeg	27·4	19	–32·1	15	9·3	—7·1	7·3	84	83·0	...	2·00	11	5·4
British Columbia	54.0	16	21·0	31	43·2	34·7	38·3	94	...	...	12·52	21	6·3

REMARKS, DECEMBER, 1882.

Mauritius.—Rainfall 1·16 in. below the average; mean temp. about the average; mean pressure, 30·031 in.; mean hourly velocity of wind 10·4 miles, extremes 25·5 miles, on 13th, and 1·6 miles, on 4th; T and L on 3rd, 5th, 20th, and 23rd, and L on 9th. C. MELDRUM, F.R.S.

Melbourne.—Mean pressure and temp. of air and of dew point slightly below the average of 24 years; humidity about the average, amount of cloud below it; rainfall ·77 in. above it; prevailing direction of wind S. and S.W., strong breezes occurring on eleven days; heavy dew on nine days; H on 14th; heavy TS on 5th; T and L on 7th and 13th; T on 9th and 14th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure (29·942 in). and mean temp. (91°·0) the same as the average of 26 years; on the whole the month was remarkably cool, the mean being attained by some occasional hot days. Rainfall ·612 in. below the average of 43 years. C. TODD.

Wellington.—Showery and very close on 2nd, 3rd, and 4th; from 5th to 10th, pleasant, with cool breezes, from S. and S.W.; fine from 11th to 17th, with very strong N.W. winds; heavy R on 18th; stormy on 20th and 21st; fine and pleasant from 22nd to 26th; showery from 27th to 29th; close of month fine. Prevailing winds, N.W. Mean temp. 62°·2, 1°·1 above the average. R. B. GORE.

Auckland.—Weather mostly bright and hot, with light winds; cloudy at the commencement of the month; very little R; barometric pressure much above the average. E. B. DICKSON.

BARBADOS.—Mean temp. 76°·0, 1° above the average of 25 years; average velocity of wind 14 miles per hour, extremes 19·5 miles and 0 miles; rainfall 60 per cent., and evaporation 13 per cent. above the average; only one day was overcast.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,

APRIL, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·52	XI.	Llanfrechfa Grange	·85
,,	Margate, Birchington...	1·23	,,	Llandovery	·90
,,	Littlehampton	1·38	,,	Solva	1·37
,,	St. Leonards	1·82	,,	Castle Malgwyn	2·41
,,	Hailsham	1·53	,,	Rhayader, Nantgwillt..	1·14
,,	I. of W., St. Lawrence.	1·56	,,	Carno, Tybritle	1·05
,,	Alton, Ashdell.....	1·26	,,	Corwen, Rhug	...
III.	Great Missenden.....	...	,,	Port Madoc	1·29
,,	Winslow, Addington ...	1·34	,,	I. of Man, Douglas	1·47
,,	Oxford, Magdalen Col...	1·07	XII.	Carsphairn	3·64
,,	Northampton	1·74	,,	Melrose, Abbey Gate...	1·45
,,	Cambridge, Beech Ho...	2·26	XIII.	N. Esk Res. [Penicuick]	1·05
IV.	Southend	1·41	XIV.	Ayr, Cassillis House ...	·55
,,	Harlow, Sheering	1·84	,,	Glasgow, Queen's Park.	2·02
,,	Diss	1·00	XV.	Islay, Gruinart School..	1·93
,,	Swaffham	1·23	XVI.	St.Andrews, NewtonBk	1·75
,,	Hindringham	2·16	,,	Aberfeldy H.R.S.	...
V.	Salisbury, Alderbury...	·96	,,	Dalnaspidal	2·41
,,	Warminster	1·22	XVII.	Keith H.R.S.	1·18
,,	Calne, Compton Bassett	·82	XVIII.	Forres H.R.S.	1·03
,,	Beaminster Vicarage ...	1·46	,,	Strome Ferry H.R.S....	1·91
,,	Ashburton, Holne Vic..	1·73	,,	Lochbroom	1·93
,,	Torrington, Langtree W.	1·41	,,	Tain, Springfield.....	...
,,	Lynmouth, Glenthorne.	1·12	,,	Loch Shiel, Glenaladale	3·99
,,	Probus, Lamellyn	2·02	XIX.	Lairg H.R.S.	1·46
,,	Taunton, Fullands	1·02	,,	Forsinard H.R.S.	1·26
VI.	Bristol, Clifton	·86	,,	Watten H.R.S.	1·28
,,	Ross	...	XX.	Fermoy, Glenville	2·83
,,	Wem, Sansaw Hall.....	...	,,	Tralee, Castlemorris ...	2·17
,,	Cheadle, The Heath Ho.	1·94	,,	Tipperary, Henry Street	2·18
,,	Worcester, Diglis Lock	·83	,,	Newcastle West	1·73
,,	Coventry, Coundon	1·23	,,	Kilrush	...
VII.	Melton, Coston	2·46	,,	Corofin	1·39
,,	Ketton Hall [Stamford]	2·57	XXI.	Carlow, Browne's Hill..	2·27
,,	Horncastle, Bucknall ...	1·55	,,	Navan, Balrath	1·22
,,	Mansfield, Market Place	2·97	,,	Athlone, Twyford	2·37
VIII.	Macclesfield, The Park.	1·82	XXII.	Mullingar, Belvedere ...	2·12
,,	Walton-on-the-Hill.....	1·18	,,	Clifden, Kylemore	4·88
,,	Lancaster, South Road.	1·90	,,	Crossmolina, Enniscoe..	2·06
,,	Broughton-in-Furness ..	...	XXIII.	Carrick-on-Shannon ...	1·18
IX.	Wakefield, Stanley Vic.	2·85	,,	Dowra	2·03
,,	Ripon, Mickley	3·03	,,	Rockcorry.....	1·54
,,	Scarborough.....	1·10	,,	Warrenpoint	2·23
,,	East Layton [Darlington]	2·43	,,	Newtownards	1·54
,,	Middleton, Mickleton ..	1·30	,,	Belfast, New Barnsley..	1·66
X.	Haltwhistle, Unthank..	1·26	,,	Bushmills	1·09
,,	Shap, Copy Hill	2·08	,,	Buncrana	1·53

APRIL, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·56	— ·46	·60	18	9	68·9	5	29·3	9	3	7
II.		Maidstone (Hunton Court)...	1·63	— ·22	·53	27	10	...	...	...	...	...	...
,,		Strathfield Turgiss	·95	— ·96	·49	27	9	67·4	5	25·8	9	7	23
III.		Hitchin	1·67	— ·28	·48	28	9	62·0	3	27·0	8	6	...
,,		Banbury	1·08	— ·93	·25	18*a*	9	63·5	5	26·5	1	7	...
IV.		Bury St. Edmunds (Culford)	1·34	— ·45	·48	19	12	70·0	18	24·0	8	7	..
,,		Norwich (Cossey)	1·71	— ·15	·56	20	9	68·5	18	22·0	7	7	8
V.		Bridport	·94	...	...	...	...	...	..	...	...	...	...
,,		Barnstaple.....	2·05	— ·33	·70	30	9	65·0	29	32·0	25	1	..
,,		Bodmin	2·20	— 1·13	·58	26	13	58·0	14	31·0	1	1	20
VI.		Cirencester	·74	— 1·66	·19	28	6	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	·91	— 1·41	·30	18	9	63·0	5	31·0	24*d*	3	16
,,		Tenbury (Orleton)	1·16	— ·71	·27	28	10	67·7	4	25·3	1	8	14
VII.		Leicester	2·15	...	·72	28	12	66·9	4	27·0	1	6	17
,,		Boston	1·64	— ·25	·50	24	9	66·0	5	29·0	1	2	...
,,		Grimsby (Killingholme).....	1·40	— ·36	·37	19	15	64·0	18	28·5	9	2	...
,,		Hesley Hall [Tickhill].....	2·23	...	·69	28	9	66·0	4,18	25·0	1	5	...
VIII.		Manchester (Ardwick).....	1·70	— ·33	·72	29	8	59·0	2, 3	31·0	1	2	...
IX.		Wetherby (Ribston Hall) ...	2·04	— ·47	·82	29	7	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·11	+ ·05	1·12	28	11	64·0	8,9	28·0	6	...	...
X.		North Shields	1·23	— ·77	·40	28	9	63·0	18	29·0	1	6	8
,,		Borrowdale (Seathwaite).....	5·00	+ ·06	1·37	29	8	62·1	27	26·5	25	...	...
XI.	WALES.	Cardiff (Ely).....	·89	— 1·45	·42	26	7	...	...	...	...	...	...
,,		Haverfordwest	2·18	— ·64	·81	18	9	62·1	12	28·0	7	8	22
,,		Plinlimmon (Cwmsymlog) ...	1·58	...	·62	18	9	...	...	...	..	...	...
,,		Llandudno.....	·83	— 1·05	·39	18	9	62·4	2	32·5	23	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·19	— ·10	1·24	28	10	61·0	11	26·8	25	5	...
,,		Hawick	1·24	— ·97	·28	19	9	...	...	...	...	...	...
XIV.		Douglas Castle (Newmains)	2·13	+ ·25	·70	28	10	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	3·44	+ ·81	·96	28	16	...	...	27·0	24	10	...
,,		Appin (Airds)	2·26	...	...	...	...	...	...	...	...	..	
,,		Mull (Quinish).....	3·43	...	·81	2	16	...	...	...	..	...	...
XVI.		Loch Leven Sluices	1·60	— ·61	·30	6*b*	9	...	...	...	...	...	...
,,		Arbroath	1·61	— ·30	·43	19	9	57·0	7	33·0	1	0	...
XVII.		Braemar	1·72	— ·36	·45	18	11	57·0	8	2·50	23	4	21
,,		Aberdeen	1·74	...	·48	19	11	62·0	7	35·0	5, 15	0	...
XVIII		Skye (Sligachan)	6·42	...	3·04	3	13	...	...	...	...	..	...
,,		Culloden	·97	— ·38	...	...	...	58·5	30	29·0	24	3	14
XIX.		Dunrobin	1·11	...	·26	4	10	59·5	11	33·5	1	0	...
,,		Orkney (Sandwick)..... ..	1·75	— ·12	·46	19	12	53·9	29	33·8	1	0	0
XX.	IRELAND.	Cork (Blackrock).....	2·92	— ·18	·98	26	17	69·0	9	30·0	8	5	...
,,		Dromore Castle	4·89	...	1·00	28	17	60·0	9*c*	30·0	20*e*	6	...
,,		Waterford (Brook Lodge) ...	2·71	...	1·32	26	11	64·5	9	28·5	8	2	...
,,		Killaloe	1·82	...	·46	2	10	64·0	20	25·0	26	10	...
XXI.		Portarlington	2·01	— ·02	·96	26	15	63·0	9	31·5	23	4	...
,,		Dublin (FitzWilliam Square)	2·21	+ ·10	1·39	26	10	60·0	4	34·3	8	0	1
XXII.		Ballinasloe	...	...	...	...	...	...	...	...	...	...	...
XXIII.		Waringstown	1·64	— ·25	·48	26	13	66·0	8	30·0	5, 13	15	18
,,		Londonderry (Creggan Res.).	1·63	...	·54	4	13	...	...	...	...	...	...
,,		Omagh (Edenfel)	1·52	— ·48	·28	2, 4	17	58·0	8,10	31·0	3,5*f*	10	...

+ Shows that the fall was above the average; — that it was below it.

a And 27. *b* And 25, 29. *c* And 10, 12, 13. *d* And 25. *e* And 22, 24. *f* And 24.

METEOROLOGICAL NOTES ON APRIL.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—True "Blackthorn" weather the greater part of the month, more genial towards the close; meadows and trees much blighted by the cold winds; spring-sown grain looking well. First swallow seen on 12th. Cuckoo first heard on 17th, nightingale on 21st; cowslip in flower on 2nd: marsh marigold on 10th, garden strawberry on 28th.

BANBURY.—Mean temp. 45°·8, about the average; S and H on 23rd.

CULFORD.—The month was unusually cold; but the early part being dry was favourable for agricultural work; distant T on 17th, S on 18th and 22nd.

COSSY.—A dry cold month; wind between S.E. and N.E. on 24 days; vegetation very backward.

CIRENCESTER.—A very dry month, of great service to the agriculturist in cultivating the land, which was in a very bad state from the previous long continued excessive rainfall; S on 23rd.

WOOLSTASTON.—A cold ungenial month, mean temp. 46°·4; swallows late in arriving, and very few in number; S on 23rd.

ORLETON.—At the beginning of the month there were several warm days; but afterwards it was generally cold, with bright days and many frosty nights; mean temp. 1°·3 below the average of twenty years; no R fell on the first twelve days, and the quantity afterwards was small, not greatly exceeding half the average. S covered the ground on the morning of the 23rd; the wind was generally N.E., and frequently very strong and cold; a very favourable month for farming operations on clay soils. Swallows first seen on 16th, whitethroat on 19th, and the cuckoo was first heard on the same day.

LEICESTER.—The early part of the month was dry and warm, no rain falling till the 12th; the latter part was cold and stormy, S and H fell on the 23rd, and heavy R on the 28th causing floods on the following day.

KILLINGHOLME.—A very favourable seed time, but pastures are very bare; good promise of blossom on apple and pear trees; swallow first seen on 15th.

SEATHWAITE.—A dry and cold month; S on mountains on 22nd.

WALES.

HAVERFORDWEST.—A remarkably fine dry cold April; mean temp. 46.°9, prevailing winds N. and E., grass temperatures particularly low, and frosts very frequent; the pressure was high during the first eleven days, but decreased after the 19th, and was low during the last week; about the 17th the wind backed to S.W., and very cold R fell mixed with S, the highlands being quite white on the 18th; vegetation very backward.

LLANDUDNO.—A fine dry month, with 132 hours of bright sunshine; the mean temp. was 2°·6, and the rainfall much below the average; the number of wet days was also small; mean humidity 74, three below the average; no frost. S on 23rd and 24th, and on the distant hills from 1st to 18th, and again towards the close of the month. Swallows first seen on 22nd. Cuckoo first heard on 28th.

SCOTLAND.

CARGEN.—A cold backward month, vegetation severely checked; mean temp. 2·°2 below the average, sunshine 37 hours below the average. T on 18th.

HAWICK.—The first half of the month was genial and spring-like, the latter half very cold with prevailing E. winds; heavy S showers fell on the 23rd and 24th, and remained on the hills, and a keen frost occurred on the night of the 25th.

ABERDEEN.—Dry bracing weather was experienced throughout the month; rainfall nearly an inch below the average; vegetation made rapid progress; vivid aurora on 3rd; H and sleet on 24th.

SLIGACHAN.—The first week was warm, with a very heavy fall of R on the 2nd, during the remainder of the month cold winds prevailed, checking vegetation, but the weather was favourable for sowing.

CULLODEN.—The month was particularly dry, with easterly winds and cold nights.

SANDWICK.—In April we had a very favourable change from the frosts and storms of March to milder, drier, and calmer weather; during the first sixteen days the wind was always from S. or W., after that date easterly; gales of forty miles an hour occurred on the 15th and 28th, and one of fifty miles on the 18th; aurora on 3rd.

IRELAND.

DROMORE.—A cold month; severe for all vegetation, grass on meadows and pastures very backward.

WATERFORD.—Rainfall below the average; prevaling winds S.E.; vegetation very backward; T on 18th; Cuckoo heard on 19th, martins seen on 17th.

KILLALOE.—Sharp cold winds from N.E. and S.E. prevailed throughout the month; temp. below the average.

DUBLIN.—A cold dry month E. and S.E. winds prevailing though not to such an extent as during March; the mean temp. was 1°·6 below the average of 18 years, but the extremes were not great; though the rainfall was above the average, the month is fittingly described as dry, rain falling on only 10 days, the average being 16, and 85 per cent. of it during 36 hours on the 26th and 27th; the amount of cloud was moderate and much sunshine was enjoyed. Auroræ were seen on 3rd, 9th, and 24th; H fell on 19th and 23rd; a dense fog prevailed on 12th.

WARINGSTOWN.—A splendid month for labour, but vegetation very backward, altogether one of the latest springs remembered.

LONDONDERRY, CREGGAN RESERVOIR.—Very favourable weather during the month.

EDENFEL.—As a seed time the month was very favourable, but N. and E. winds prevailed almost continuously, which coming after so cold a March greatly retarded vegetation; in fact, there was but little spring weather; swallows arrived on 19th; cuckoo and corn-crake on 27th.

MEASUREMENT OF SNOW.

To the Editor of the Meteorological Magazine.

SIR,—I cannot help thinking Mr. Stow close to the mark in urging that the one-twelfth measure can only give very rough results. During the snow storm of January, 1881, I made some careful experiments by filling a copper 3 in. cube, as to 1 and 2 on the same day, and all with the same fall. The results were as under :—

(1) *Loose* snow melted into about one-fourth of its bulk of water; (2) *Compact trodden down snow* into one-third of its bulk; and (3) *Snow compressed by its own weight during the previous night's thaw* into seven-twelfths.

Evidently the melting or weighing process is the only one to be depended on where accuracy is required.—Yours truly,

J. RAND CAPRON.

Guildown, Guildford, April 18th, 1883.